Huntington (Geo. S.)

# CORROSION ANATOMY, TECHNIQUE AND MASS.

Illustrated by Specimens and Diagrams.

DR. GEORGE S. HUNTINGTON, A. M., M. D., PROFESSOR OF ANATOMY, MEDICAL DEPARTMENT, COLUMBIA UNIVERSITY, NEW YORK CITY.

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# CORROSION ANATOMY, TECHNIQUE AND MASS.

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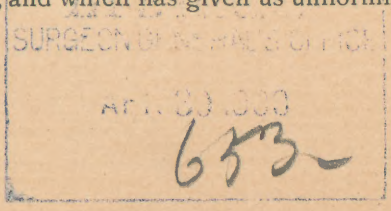
DR. G. S. HUNTINGTON OF NEW YORK CITY.

Corrosion has long occupied a somewhat peculiar position among methods of anatomical demonstration. As Hyrtl has shown, corroded preparations existed in the museum of Ruysch, and since that time corrosion has been practiced to a greater or less extent by many prominent investigators. It is scarcely possible to overestimate the value of demonstrations which the method yields. Many problems of vascular supply, especially of the viscera, the arrangement and distribution of ducts and canals, cannot be elucidated by any other means. Notwithstanding the obvious advantages of corrosion as an aid in anatomical investigation, the method has not received the attention which its merit warrants. The reason for this neglect must be sought primarily in certain difficulties inherent in the method itself. Having had occasion to practice corrosion somewhat extensively during the past six years, I have thought it worth while to communicate some of the results of our experience to the Association at this meeting, and I may deal with the matter under the following headings:

I. MASS.—The selection of the proper injection mass is, of course, the element most important to the success of the method.

It is curious to note that the secrecy with which Ruysch surrounded his method of preparing corrosions seems to have been imitated to a greater or less extent by his successors. It is a matter of regret that the information which Hyrtl gives on the composition of the mass in his large work on "Corrosion-Anatomie" is so unsatisfactory. Personally I look back on much time and material expended in fruitless attempts at following his instructions. In spite of the utmost care, we have found it impossible to obtain even moderately successful permanent corrosions with the mass recommended by him, and we were obliged to experiment extensively before obtaining the composition which we now use, and which has given us uniformly good



results. In developing this mass the following essential requirements have been kept in view:

1. The mass must fuse at a comparatively low temperature (water bath).

2. After hardening, the mass should be brittle rather than plastic. Masses which on fracture show a crystalline surface are in general to be preferred. It is absolutely necessary to have a mass which will withstand, without softening, the high temperatures of our summer months.

It is very easy, working with a soft mass, to obtain brilliant preparations, which will at first preserve their shape and relations, but which will wilt and droop out of all resemblance to the original during the first summer. Corrosion preparations which are to be permanent must possess sufficient rigidity and resistance to summer temperature.

3. The mass should take color readily and harden uniformly without cracking and splitting.

4. The rapidity of hardening is a point of some importance to the beauty of the preparations, especially if heavy suspended coloring material is used. If the mass hardens too slowly and if the vessels are large, the suspended coloring matter may sink to the lowest point of the cast, and the preparation will appear stratified and not uniformly colored.

The basis of a mass fulfilling the above requirements is a paraffin product called "ozokerit." It occurs in its natural crude state in petroleum regions, mixed with considerable oil, as a yellow, cheesy "mineral wax." This crude material can be freed from the admixture of oil, and the refined product is known in the trade as "white ozokerit." This paraffin is characterized by its toughness, and by the fact that even in the form of long and slender rods it retains shape and direction without bending or warping. My attention was called to this substance by finding that it is generally employed for the manufacture of "adamantine" dinner candles, which are designed not to bend or twist when moderately warmed.

For general work we have combined this material with other ingredients in the following proportions:

Ozokerit, . . . . . 3 parts (by weight).
Paraffin (45°–50° C.), . . . 2 parts (by weight).
White Wax, . . . . . 1 " " "
Rosin, . . . . . $\frac{1}{6}$ " " "
Venice turpentine about two drachms to a quart of mass.

This combination gives a freely flowing mass, satisfactory for all ordinary purposes, such as lungs, liver, placenta, etc.

When very large vessels are to be injected, as the aorta or trachea of large ruminants, it is desirable to increase the proportion of ozokerit to four or five parts.

The addition of a small amount of stearin to the above mass is also of advantage for the injection of large vessels or cavities. For very delicate injections the mass may be made softer and more fluid by increasing the proportion of wax. In general, however, this is not desirable, as the resulting preparations cannot resist summer temperatures.

*Preparation of Mass.*—The ozokerit, paraffin and wax are melted together over the water bath. When entirely fluid the Venice turpentine and the finely powdered rosin are added—a portion of the rosin will slowly dissolve in the melted paraffin, the residue remaining at the bottom of the vessel. Masses which have been repeatedly heated take up additional rosin.

*Coloring of Mass.*—The mass can be colored with dry, finely powdered or precipitated coloring matter, such as English vermillion, cobalt or ultramarine blue, Prussian blue, chrome green and chrome yellow, purple lake, rose madder, etc. I have, however, found it more advantageous to employ the oil colors put up in tubes. The Masury colors have given the best results. They offer a large variety of shades, and incorporate readily and completely with the mass, producing a brilliant and uniform coloring.

The coloring matter should be added to the melted mass slowly, in small quantities and under constant stirring. Tests should be made from time to time, by allowing a few drops of the mass to fall into cold water, so as to obtain the color of the hardened mass.

To obtain *white* mass, it is only necessary to melt the ozokerit, paraffin and wax in the proportions indicated, without the addition of the Venice turpentine and rosin. It is much better, however, to retain the last named ingredients, which add a faint, yellowish tinge to the mass, but which at the same time considerably increase the rigidity of the preparations.

II.—Injection.—*Syringe and Canulæ.*—The ordinary hand syringe is best adapted to corrosion injection. Great care is necessary to prevent the leather piston of the syringe from hardening by the heat of the injection mass. Frequent applications of vaseline will help to preserve the leather. We have of late years used a syringe with metal piston, made by W. Katsch, of Munich, for all warm injections, and have found the same well adapted for the purpose.

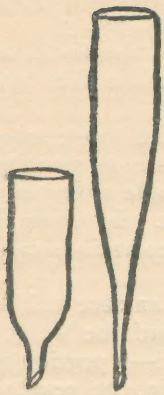


Fig. 1. Fig. 2.

The canulæ are best made out of glass tubing, as they can be left in place during the process of corrosion. A practical point in making the canulæ deserves notice. The tubing should narrow abruptly to the caliber of the point, and the narrow portion should not be longer than is required for insertion and ligature. Fig. 1 shows the shape of the canulæ. If the tubing is drawn out gradually (Fig. 2), the injection mass is apt to cool and harden in passing through the long, narrow portion, and the injection will not be successful. All precautions have to be taken to avoid blocking the injection by hardening of the mass at any point before the process is finished. Before beginning the injection, the syringe and canulæ should be heated in warm water.

In preparing an organ for injection the blood should be removed as far as possible from the vessels. This cannot be done by washing out, as the fluid used will remain in the smaller vessels and interfere with the penetration of the mass. Careful "milking" is perhaps the best method of emptying the veins. Clots in the larger vessels must be removed before injection. For many viscera, especially if fine injections are desired, it is better to make the injections with the object floated in warm water. This is especially desirable when the organ to be injected is somwhat flaccid and soft, as pancreas and spleen, and would tend to flatten if not supported by being floated. If the entire organ is placed in warm water for fifteen or twenty minutes before injection the smaller vessels will be filled more readily.

If a number of structures are to be injected in one viscus we have found it of advantage to inject the duct first, then the arteries and lastly the veins. If the veins are injected first they will frequently become so much distended that they interfere by pressure with the complete injection of the other canals.

When once begun the injection must be made continuously without interruption. It is well to employ a syringe of sufficient capacity to take the entire amount of mass desired for any one injection. The time required for removing and refilling the syringe will frequently be enough to allow the mass to harden in the canula, thus interfering with the further injection.

The injection must be made gently, as the heat of the mass is apt to weaken the walls of the vessels somewhat, and extravasations will result if undue force is employed.

In every case the organ must be injected in the vessel (glass)

in which the corrosion is to take place. The object must not be touched or moved in any way after the injection is completed. The canulæ are left in place, both because their removal would disturb the organ, and because they subsequently form convenient handles for turning the corroded specimen in the acid bath and during the other manipulations. The vessel used must be sufficiently deep to permit the complete covering of the organ when the acid is added.

If the organ has been injected in warm water, it is desirable to cool the mass after injection by allowing a stream of cold water to run through the vessel, taking care that the current is not strong enough to injure the injection or cause the organ to strike against the sides of the vessel. Especially when large vessels are injected, the rapid cooling will give the cast a more uniform coloring. If it is allowed to cool gradually, the coloring matter is apt to settle to the lowest point in the cast of larger vessels or cavities.

III.—Corrosion.—Any water remaining in the vessel after the injection has been cooled should be removed by siphon.

The best acid for corrosion is strong (fuming) commercial hydrochloric acid. This should be gently poured into the dish containing the injected organ until the same is entirely covered. In the great majority of cases the injected object will float at first in the acid, which has a high specific gravity. It is well to cover the dish with a plate, so as to confine the acid vapors. The entire process of corrosion should be conducted either out of doors or under a properly constructed chemical hood, as the hydrochloric acid vapors will speedily destroy all iron and steel objects in the laboratory. After corrosion has been completed, a portion of the acid can be drawn off with the siphon and used over again. As long as the acid *fumes*, it is sufficiently strong for corrosion. Acid which no longer fumes should be thrown away. Many organs (such as liver) will not corrode in weak acid, which, on the contrary, hardens them.

The length of time required for corrosion will, of course, vary with the size and character of the injected object. Ordinarily three or four days to a week suffice.

Corrosion is usually complete when the surface of the object appears of a soft grumous and pasty consistency.

The remnants of the corroded tissues are to be washed away with a gentle stream of cold water, continued until the entire cast appears clean.

After drying, it is well to cover the cast with a fine coating of varnish, which will increase its strength. As turpentine varnishes

would soften the wax and paraffin, an alcoholic solution of shellac must be used (known in the trade as " French varnish "). I have found that this is best applied as a spray. We have used a compressed air apparatus and one of the small atomizers which are made for spraying the throat. If the varnish is thick it is well to dilute the same with alcohol, so as to pass readily through the atomizer.

After the varnishing is finished the object can be mounted in various ways. We have found it advisable to mount the majority of our corrosions on flat disks of wood (painted black or white) or squares of plate glass (when it is desirable to see both sides of the preparation).

Corrosions which are mounted on metal stands or suspended, suffer sooner or later from unavoidable jars and knocks. They are in addition much more liable to become bent and distorted during the hot term. But if they are supported by allowing a considerable portion of the surface to rest on the mounting disk or plate they retain their shape well and form permanent museum preparations of great value and beauty.